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Growth performance and carcass traits of forage-fed hair sheep wethers

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Abstract

The objective of the present study was to compare live animal performance and carcass characteristics of 3/4 or 7/8 Dorper (DO; $n = 30$), purebred Katahdin (KA; $n = 20$), purebred St. Croix (SC; $n = 17$) and purebred Suffolk (SU; $n = 10$) lambs born in the spring and fall of 2001. After weaning, lambs were supplemented with up to 680 g of a corn-soybean meal supplement while grazing bermudagrass pastures overseeded with ryegrass. Lambs were slaughtered at approximately 210 d of age. From birth to weaning, DO lambs gained faster ($P < 0.001$) than KA or SC lambs, whereas KA lambs had higher ($P < 0.001$) ADG than SC lambs. Additionally, DO and SU wethers had greater ($P < 0.02$) ADG from weaning to slaughter than SC or KA wethers. Suffolk lambs were heavier ($P < 0.001$) at slaughter and produced heavier ($P < 0.001$) carcasses than lambs from hair-sheep breeds. Carcasses of KA lambs were fatter (actual fat thickness; $P < 0.02$) resulting in higher yield grades ($P < 0.03$) than carcasses of DO, SC, or SU lambs. Carcasses of DO and SU had larger ($P < 0.001$) longissimus muscle (LM) areas than those of KA or SC carcasses, whereas kidney fat weight and percentage were greater ($P < 0.001$) in carcasses from KA and SC than DO and SU lambs. Lean maturity was similar ($P = 0.32$) among breed-types. However, skeletal maturity was greater ($P < 0.001$) in SU than hair-sheep carcasses. Flank-streaking scores were similar ($P = 0.19$) among the breed-types, but conformation scores were higher ($P < 0.001$) for DO and SU carcasses and resulted in higher ($P < 0.001$) quality grades than SC carcasses. The LM of SU lambs was lighter (higher L^* values; $P < 0.05$) than that of KA and SC lambs, whereas the LM from DO lambs was redder (higher a^* values; $P < 0.001$) than SC and SU and more ($P < 0.001$) yellow than that of the other breed-types. Chops from SU lambs were tougher (higher shear force values; $P < 0.007$) than chops from the hair-sheep breeds. Results of this study indicate that ADG, carcass muscularity and meat quality were similar between DO and SU lambs, and, although fatter, carcass muscularity of KA was similar to that of DO lambs.

Keywords: Carcass; Growth; Hair sheep; Lamb; Quality; Shear force

1. Introduction

The interest in “easy-care” hair breeds of sheep has grown in recent years, especially in southern states. Hair sheep do not require shearing, and tend to be parasite resistant (Zajac et al., 1990; Gamble and Zajac, 1992; Wildeus, 1997; Burke and Miller, 2002, 2004); thus, they require less maintenance for internal parasites and can be used in extensive grazing operations. Hair breeds include Katahdin, developed in the U.S., St. Croix, a tropically-derived breed, and Dorper, a South African composite breed derived from the Persian Blackhead and Horned Dorset. The Dorper is the most recent addition to the hair breeds in the U.S., imported in 1995. The larger frame

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size and muscling make the Dorper a more attractive option in lamb production than the St. Croix; yet, the St. Croix appear to be more resistant to parasites than the Dorper (Burke and Miller, 2002, 2004).

In hair sheep, fat appears to be deposited internally rather than externally when compared to wool breeds of sheep (Boyd, 1983; Shelton, 1983; Horton and Burgher, 1992). Because Dorper sheep are early maturing, they tended to be fatter at lighter weights (Cloete et al., 2000), and have been shown to deposit more external fat than Suffolk-sired lambs (Snowder and Duckett, 2003) or purebred Katahdin and St. Croix lambs (Burke et al., 2003). Furthermore, carcasses of Dorper × Rambouillet lambs were fatter than carcasses of purebred Rambouillet sheep (Moss et al., 2000).

Management of hair breed lambs often includes finishing on grass pastures rather than in a feedlot because concentrate feeds are less available in their areas of origin. However, little has been reported on performance and carcass traits of hair-sheep breeds finished on grass pastures. Therefore, the objective of this study was to compare live animal performance and carcass characteristics of Dorper, Katahdin and St. Croix lambs to Suffolk lambs raised on grass pastures.

2. Materials and methods

2.1. Animals and experiment

All experimental procedures were reviewed and approved by the Agricultural Research Service Animal Care and Use Committee in accordance to National Institute of Health guidelines for Care and Use of Laboratory Animals. Hair-sheep breeds evaluated in this study included 3/4 and 7/8 Dorper (DO; $n = 30$), Katahdin (KA; $n = 20$), St. Croix (SC; $n = 17$), and Suffolk (SU; $n = 10$) wethers. Graded (3/4 to 7/8) DO lambs, representative of the breed-type common to southeastern U.S., were offspring of four purebred DO rams mated to DO × SC or DO × Romanov ewes. St. Croix lambs originated from the mating of a SC sire that was unrelated to SC ewes maintained as a primarily closed ewe flock for more than 12 years, whereas an unrelated KA ram was mated to purebred KA ewes (three genetic lines) to produce the KA wethers used in this study. All hair-sheep lambs were born in either the spring (February and March, 2001) or fall (October, 2001) at the Agricultural Research Service (ARS) research farm in Booneville, AR. Conversely, commercial SU lambs were born in February and March, 2001, and were purchased from a local producer at weaning. After weaning, all lambs were co-mingled.

Birth weights of hair-sheep lambs were recorded by ARS personnel, and lambs were pasture-raised, without creep feed, until weaning at approximately 60 d of age. At weaning, all lambs (including SU lambs) were vaccinated with Covexin 8 (Schering-Plough Animal Health Corp., Kenilworth, NJ) and treated for gastro-intestinal parasites with Ivomec sheep drench (Merial Limited, Iselin, NJ). A booster of Covexin 8 was administered 6 weeks after initial vaccination. Lambs grazed together on a 2.8-ha bermudagrass pasture overseeded with annual ryegrass at a stocking rate of approximately 24 lambs/ha. Grazing lambs were fed 680 g/lamb of corn-soybean meal supplement one time daily, and had ad libitum access to water and free choice trace mineralized salt. Body weight was recorded at 28-d intervals between weaning and slaughter to calculate ADG.

2.2. Lamb slaughter and carcass data collection

Lambs were slaughtered at approximately 210 d of age. Lambs were transported 151 km to the University of Arkansas Red Meat Abattoir, and feed and water were withheld from lambs for approximately 12 h before slaughter. Lambs were rendered unconscious and insensitive to pain by captive-bolt stunning, exsanguinated, and dressed according to industry-accepted procedures. Hot carcass weight was recorded, and carcasses were chilled for 7 d at 1 °C before carcass data collection and fabrication.

After the 7-d chilling period, carcasses were reweighed, and the difference between hot and chilled carcasses weights was used to calculate cooler shrinkage. Carcass quality grade data (skeletal and lean maturities, flank-streaking, and conformation) were then collected by an experienced evaluator in accordance with USDA (1992) grading standards for young lamb. Carcasses were subsequently ribbed between the 12th and 13th ribs, and fat thickness over the center of the longissimus muscle (LM) was measured with a backfat probe to calculate yield grade (USDA, 1992). Area of the LM was traced upon acetate paper and measured with a compensating planimeter, whereas body wall thickness was measured 7.5 cm distal to the ventral edge of the LM.

Prior to carcass fabrication, all kidney and pelvic fat (including both kidneys) was removed from each carcass and weighed, and the percentage of internal fat was calculated as a percentage of the chilled carcass weight. Carcasses were then fabricated into primal cuts according to National Association of Meat Purveyors (NAMP) specifications (NAMP, 1992) for lamb.

The primal rack (NAMP #204) was further processed into 2.5-cm thick LM chops, and instrumental color of the LM was measured on two chops with a Hunter MiniScan XE (model 45/0-L; Hunter Associates Laboratory Inc., Reston, VA) after a 30-min bloom period at 4 °C. Commission Internationale de l'Eclairage (CIE, 1976) L^*, a^*, and b^* values were determined from the mean of six readings (three from each chop) using illuminant C and a 10° standard observer.

The remaining LM chops from the primal rack were individually weighed, then cooked to an internal temperature of 71 °C in a Blodgett convection oven (Blodgett Oven Co., Burlington, VT) preheated to 165 °C. Thermocouples were inserted into the geometric center of each chop, and endpoint temperature was monitored with a multi-channel data recorder (VAS Engineering Inc., San Diego, CA). Chops were allowed to cool to room temperature, blotted dry with paper towels, and reweighed. The difference between pre- and post-cooked weights was divided by the precooked weight to calculate cooking loss percentages. Then, five to six 1.27-cm diameter cores were removed (one to two cores/chop depending on chop size) parallel to the muscle fiber orientation, and sheared once through the center with a Warner-Bratzler shear apparatus (in compression) attached to an Instron universal testing machine (model 4466; Instron Corp., Canton, MA) with a 55-kg load cell and a crosshead speed of 250 mm/min.

2.3. Statistical analyses

All data were analyzed as a randomized complete block design with season of birth as blocks and individual lamb/carcass as the experimental unit. Analysis of variance was generated using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC), and the statistical model included the lone main effect of breed-type. Least squares means were computed for the main effect, and separated statistically by pair-wise *t*-tests (PDIFF option of SAS) when $P \leq 0.05$. Hot carcass weight was used as a covariate for carcass traits and was significant for fat thickness, body wall thickness, kidney fat weight, yield grade, conformation score and quality grade. Therefore, adjusted LS means were presented for these traits.

3. Results and discussion

3.1. Live animal performance

St. Croix lambs were heavier ($P < 0.05$) at birth than DO lambs; however, from birth to weaning, growth rate was greatest ($P < 0.001$) in DO lambs and lowest ($P < 0.001$) in SC lambs (Table 1). At weaning, SU wethers were heavier ($P < 0.001$) than DO, KA and SC wethers, and this may be attributed to differences in pre-weaning feeding and management between SU and the hair-sheep breeds. Moreover, SU lambs were heavier ($P < 0.001$) at slaughter than hair-sheep lambs. Among the hair-sheep breeds, DO and KA lambs were heavier ($P < 0.001$) at weaning and slaughter than SC lambs. From weaning to slaughter, DO and SU wethers had greater ($P < 0.02$) ADG than KA and SC wethers.

Schwulst and Martin (1995) reported that KA-sired lambs had similar birth and weaning weights to Rambouillet- and Tunis-sired lambs, but KA lambs had the lowest pre-weaning ADG. In agreement with results of the present study, SC lambs were found to be heavier at birth than Barbados Blackbelly and Florida Native lambs, but pre-weaning ADG and weaning weights were similar among these hair-sheep breeds (Godfrey et al., 1997). Even though weaning weights of forage-fed DO lambs in the current study were similar to those of a previous study (Burke et al., 2003), pre-weaning ADG of DO wethers in this study was greater than DO sheep in other studies (Burke et al., 2003; Schoeman and Burger, 1992; Basson et al., 1970).

Several studies have demonstrated that SC sheep have slower growth rates than wool breeds and hair-

Table 1
Growth performance of forage-fed Dorper, Katahdin, St. Croix, and Suffolk wethers

Item	Sheep breed-type					
	Dorper	Katahdin	St. Croix	Suffolk	S.E.M.	P
Number	30	20	17	10		
Birth weight (kg)	3.1^{y}	$3.4^{x,y}$	3.7^{x}	–	0.18	<0.05
Weaning weight (kg)	18.7^{y}	17.7^{y}	15.5^{z}	26.0^{x}	0.77	<0.001
Slaughter weight (kg)	38.4^{y}	38.4^{y}	34.2^{z}	45.7^{x}	1.01	<0.001
Average daily gain (g/d)						
Birth to weaning	267.4^{x}	236.2^{y}	189.8^{z}	–	9.30	<0.001
Weaning to slaughter	147.1^{x}	127.4^{y}	119.3^{y}	156.8^{x}	7.60	<0.02

^{x,y,z}Within a row, least square means lacking a common superscript letter differ ($P < 0.05$).

sheep × wool-sheep (Phillips et al., 1995; McClure and Parker, 1991; Ockerman et al., 1982). Horton and Burgher (1992) noted that ADG of KA and Dorset lambs were similar and greater than SC lambs. However, Wildeus et al. (2001) reported similar post-weaning gains of KA and SC lambs fed a moderate growth diet. In contrast to the present results, Bunch et al. (2004) reported similar post-weaning gains among SC, DO × SC and DO × wool-sheep breed lambs when fed a typical lamb finishing diet. Yet, Burke et al. (2003) reported that the ADG of DO × SC lambs was greater than SC and DO × Romanov × SC lambs when fed a high-concentrate diet (Burke et al., 2003). Moreover, DO lambs have been shown to have similar or greater ADG than several wool-sheep breeds (Basson et al., 1970; Cloete et al., 2000; Notter et al., 2004).

3.2. Carcass cutability

Suffolk lambs produced the heaviest ($P < 0.001$) hot and chilled carcass weights, whereas SC lambs produced the lightest ($P < 0.001$) carcasses (Table 2). Dressing percentage was greater ($P < 0.05$) for DO and SU wethers than KA wethers.

Godfrey and Collins (1999) reported that SC lambs produced lighter hot and chilled carcass weights than SU × SC lambs. Yet, Phillips et al. (1995) found no difference in chilled carcass weights between SC-, Romanov-, and Texel-sired sheep. Similar to present results, dressing percentage was similar between DO- and SU-sired sheep (Snowder and Duckett, 2003) and DO- and Dorset-sired sheep (Notter et al., 2004), and SC lambs had lower dressing percentages than wool-sheep breeds (McClure et al., 1991). Conversely, Horton and Burgher (1992) reported higher dressing percentages in SC and KA compared to Dorset lambs.

Carcasses of KA lambs were fatter (actual fat thickness; $P < 0.02$), resulting in higher ($P < 0.03$) yield grades, than carcasses from DO, SC, and SU lambs (Table 2). After adjusting for hot carcass weight, fat thickness was similar between KA and SC, which were still fatter than DO and SU carcasses ($P < 0.001$). Thus, yield grade became similar between KA and SC carcasses ($P < 0.002$). Kidney fat weight and percentage were greater ($P < 0.001$) in KA and SC carcasses than DO and SU carcasses. After adjusting for carcass weight, kidney fat weight was lightest in SU lambs ($P < 0.001$). Body wall thickness was not ($P = 0.16$) different among DO, KA, SC, and SU carcasses until carcass weight was used as a covariate. Body wall thickness then was lowest in SU carcasses ($P < 0.001$).

Even though external fat thickness was not different among carcasses of SC, Barbados Blackbelly and Finnsheep sheep (Ockerman et al., 1982), SC lambs

Table 2
Carcass cutability characteristics of forage-fed Dorper, Katahdin, St. Croix, and Suffolk wethers

Item	Sheep breed-types					
	Dorper	Katahdin	St. Croix	Suffolk	S.E.M.	P
Hot carcass weight (kg)	19.5^{y}	18.1^{z}	16.8^{z}	23.8^{x}	0.55	<0.001
Dressing percentage (%)	51.0^{x}	47.1^{y}	49.1^{x,y}	52.7^{x}	1.28	<0.05
Chilled carcass weight (kg)	18.1^{y}	16.9^{y,z}	15.6^{z}	20.7^{x}	0.59	<0.001
Cooler shrinkage (%)	6.6^{y}	6.2^{y}	6.2^{y}	13.0^{x}	0.87	<0.001
Fat thickness (mm)	3.0^{y}	4.4^{x}	2.5^{y}	2.6^{y}	0.44	<0.02
Adjusted fat thickness[b] (mm)	2.9^{y}	4.7^{x}	3.2^{x}	1.2^{y}	0.44	<0.001
Body wall thickness (mm)	13.1	14.0	14.0	11.2	0.73	<0.16
Adjusted body wall thickness[b] (mm)	12.8^{y}	14.7^{x,y}	15.6^{x}	8.0^{z}	0.68	<0.001
Kidney fat weight (kg)	0.42^{y}	0.53^{x}	0.59^{x}	0.38^{y}	0.036	<0.001
Adjusted KF weight[b] (kg)	0.41^{y}	0.56^{x}	0.65^{x}	0.27^{z}	0.031	<0.001
Kidney fat (%)[a]	2.2^{y}	2.9^{x}	3.5^{x}	1.5^{z}	0.16	<0.001
Longissimus muscle area (cm^2)	12.3^{x}	11.0^{y}	7.7^{z}	13.6^{x}	0.45	<0.001
Longissimus muscle area (cm^2/kg)	0.62^{x}	0.61^{x}	0.47^{y}	0.58^{x}	0.020	<0.001
Yield grade[c]	1.6^{y}	2.1^{x}	1.5^{y}	1.5^{y}	0.17	<0.03
Adjusted yield grade[b]	1.6^{y}	2.2^{x}	1.7^{x,y}	1.0^{y}	0.18	<0.002
Retail product yield[d]	48.9^{x}	48.4^{x,y}	47.5^{z}	48.8^{x}	0.20	<0.001

^{x,y,z}Within a row, least square means lacking a common superscript letter differ ($P < 0.01$).

[a] Kidney fat reported as a percentage of the chilled carcass weight.

[b] Variable adjusted for hot carcass weight using covariate analysis.

[c] Yield grade = (10 × fat thickness, in.) + 0.04 (USDA, 1992).

[d] Retail product yield = (49.94 − 0.085 × hot carcass weight, lb.) − (4.376 × adjusted fat thickness, in.) − (3.53 × body wall thickness, in.) + (2.456 × longissimus thoracic area, sq. in.).

were trimmer at the 12th rib than Targhee (McClure et al., 1991; Solomon et al., 1991), DO-sired (Burke et al., 2003) SU × SC, Gulf Coast Native × SC (Godfrey and Collins, 1999), and Florida Native (Foote, 1983) sheep. Furthermore, Bunch et al. (2004) reported similar fat thickness between DO × SC and SC lambs raised intensively. Moreover, Dorper lambs raised on pasture in the current study were leaner than DO lambs fed a high-concentrate diet (Burke et al., 2003). In agreement with present results, Snowder and Duckett (2003) and Notter et al. (2004) found that external fatness was similar between DO- and SU-sired or Dorset-sired lambs, but fat thickness was greater in carcasses from DO-sired than SU-sired (Snowder and Duckett, 2003) and purebred Rambouillet lambs (Moss et al., 2000). Interestingly, actual body wall thickness was not affected by breed-type, regardless of whether raised extensively on pasture (current study) or intensively on a high-concentrate diet (Burke et al., 2003).

Even though kidney fat weight was similar between DO and SU carcasses in the current study, kidney fat percentage was greater ($P < 0.001$) in DO carcasses (Table 2). The consensus of available literature indicates that hair-sheep breeds tend to deposit greater amounts of internal fat than more traditional sheep breeds. For example, carcasses from SC, KA, and Barbados Blackbelly sheep had considerably more kidney and pelvic fat than carcasses from wool/meat-sheep breeds (Horton and Burgher, 1992; Boyd, 1983; Shelton, 1983). Moreover, Burke et al. (2003) reported that the percentage of internal fat was greater in carcasses of SC × Romanov lambs than DO-sired or purebred KA lambs. Conversely, Solomon et al. (1991) noted that the percentage of kidney and pelvic fat was identical between SC and Targhee carcasses.

Actual LM area of carcasses from DO and SU was larger ($P < 0.001$) than those of carcasses from KA and SC, and KA carcasses had larger ($P < 0.001$) actual LM area than SC (Table 2). When LM area was expressed on a hot carcass weight basis (cm^2/kg), LM area of DO, KA, and SU lambs was larger ($P < 0.001$) than the LM area of SC lambs. Results of the present study concur with those of Solomon et al. (1991), McClure et al. (1991), and Horton and Burgher (1992) who showed that SC or KA carcasses had smaller LM areas than wool-sheep breeds. Moreover, LM areas of carcasses from forage-fed KA and SC lambs may have been smaller than those reported for KA and SC sheep fed a high-concentrate diet (Burke et al., 2003). The LM area of DO lambs in the current study was similar to carcasses of DO-sired lambs fed a high-concentrate diet (Burke et al., 2003), even at lighter hot carcass weights.

3.3. Carcass quality

Skeletal maturity was greatest ($P < 0.001$) in SU compared with hair breed carcasses, and overall maturity tended to be greater ($P = 0.09$) in SU than DO carcasses, even though lean maturity was not ($P = 0.32$) different among the breed-types (Table 3). Although carcasses of DO, SC, KA, and SU had similar ($P = 0.19$) flank-streaking scores, carcasses of DO and SU wethers received higher ($P < 0.001$) carcass conformation scores, resulting in higher ($P < 0.001$) quality grades, than KA and SC wethers. Furthermore, carcasses of KA lambs received higher ($P < 0.001$) conformation scores and quality grades than carcasses from SC lambs. However, by adjusting conformation score using carcass weight as a covariate, scores were similar among KA, SC, and SU, and greatest in DO carcasses ($P < 0.001$). Adjusted qual-

Table 3
Carcass quality grade characteristics of forage-fed Dorper, Katahdin, St. Croix, and Suffolk wethers

Item	Sheep breed-types					
	Dorper	Katahdin	St. Croix	Suffolk	S.E.M.	P
Skeletal maturity[a]	164.9^{y}	164.5^{y}	168.6^{y}	188.0^{x}	3.36	<0.001
Lean maturity[a]	157.6	164.5	163.4	158.2	3.28	<0.32
Overall maturity[a]	161.2^{y}	164.5^{x,y}	166.0^{x,y}	173.1^{x}	2.77	<0.09
Flank-streaking[b]	296.1	318.5	257.5	296.6	18.82	<0.19
Conformation[c]	10.6^{x}	9.4^{y}	8.2^{z}	11.0^{x}	0.27	<0.001
Adjusted conformation[d]	10.4^{x}	9.7^{x,y}	8.9^{y}	9.7^{x,y}	0.24	<0.001
Quality grade[c]	10.9^{x,y}	10.4^{y}	9.4^{z}	11.3^{x}	0.22	<0.001
Adjusted quality grade[d]	10.8^{x}	10.7^{x}	9.8^{y}	10.4^{x,y}	0.20	<0.003

^{x,y,z}Within a row, least square means lacking common superscript letters differ ($P < 0.05$).
[a] 100–199 = Young (A-maturity) lamb.
[b] 200–299 = Slight, and 300–399 = Small.
[c] 8 = average U.S. Good; 9 = high U.S. Good; 10 = low U.S. Choice; 11 = average U.S. Choice; and 12 = high U.S. Choice.
[d] Variable adjusted for hot carcass weight using covariate analysis.

Table 4
Longissimus muscle quality characteristics of forage-fed Dorper, Katahdin, St. Croix, and Suffolk wethers

Item	Sheep breed-types					
	Dorper	Katahdin	St. Croix	Suffolk	S.E.M.	P
Instrumental color[a]						
L^*	$32.7^{x,y}$	$31.8^{y,z}$	31.5^{z}	33.6^{x}	0.44	<0.05
a^*	17.5^{x}	$16.8^{x,y}$	15.2^{z}	$15.4^{y,z}$	0.42	<0.001
b^*	15.4^{x}	14.4^{y}	13.2^{z}	$13.9^{y,z}$	0.39	<0.001
Cooking loss (%)	28.9^{y}	29.6^{y}	$29.7^{x,y}$	33.2^{x}	1.00	<0.10
Shear force (kg)	3.8^{y}	4.0^{y}	3.8^{y}	5.9^{x}	0.35	<0.007

[x,y,z] Within a row, least square means lacking a common superscript letter differ ($P<0.05$).
[a] L^* values are a measure of darkness to lightness (larger values indicate a lighter color); a^* values are a measure of redness (larger values indicate a redder color); and b^* values are a measure of yellowness (larger values indicate a more yellow color).

ity grade was still lowest in SC, but similar between SC and SU carcasses ($P<0.003$).

Similar to results of this study, Burke et al. (2003) failed to detect a difference in carcass maturity among hair-sheep breed-types fed a high-concentrate diet. However, carcasses of SC lambs received the lowest flank-streaking and carcass conformation scores, resulting in the lowest quality grades when compared to carcasses of DO-sired and KA sheep. Moreover, quality grades were similar between DO- and Columbia- or Suffolk-sired lambs (Snowder and Duckett, 2003), or Dorset-sired lambs (Notter et al., 2004) and similar, or greater, quality grades than Rambouillet lambs (Moss et al., 2000). In contrast, Bunch et al. (2004) found that SC-sired lambs received higher quality grades than DO-sired lambs, but all carcasses graded U.S. Good, or lower. Not surprisingly, quality grades of forage-fed hair sheep in the present study were lower than those of carcasses from hair sheep fed a high-concentrate diet (Burke et al., 2003).

Chops from SU carcasses were lighter-colored (higher L^* value; $P<0.05$) than that of KA and SC chops, and chops from DO carcasses had higher ($P<0.05$) L^* values than those from SC carcasses (Table 4). Moreover, chops from DO carcasses were redder (higher a^* value; $P<0.001$) than SC or SU chops, and more ($P<0.001$) yellow (higher b^* value) than chops from the other breed-types. Results of the present study confirm those of Burke et al. (2003), who found no difference in L^* values among hair-sheep breed-types, and that the LM of SC lambs was less red and less yellow than the LM from DO-sired and KA lambs. Higher L^*, a^*, and b^* values in lamb meat are more desirable (Geesink et al., 2000).

Cooking losses tended to be greater ($P<0.10$) in chops from SU than DO and KA lambs (Table 4). More importantly, LM chops from DO, KA, and SC wethers were more tender (lower shear force values; $P<0.007$) than those from SU wethers. In contrast to current results, Burke et al. (2003) reported that cooking losses were greatest in chops from KA than DO-sired lambs. Yet, several studies have shown that Warner-Bratzler shear force values were lower in LM chops from DO-sired lambs than SU-sired (Snowder and Duckett, 2003), as well as Dorset- and SU-sired lambs (Greiner et al., 2004). Furthermore, Ockerman et al. (1982) showed that LM chops from SC lambs were rated more tender and juicier than chops from Barbados lambs, and Greiner et al. (2004) found that trained sensory panelists rated chops from DO lambs more tender than Dorset- and SU-sired lambs.

4. Conclusions

In conclusion, results of the present study indicate that these populations of hair-sheep and wool/meat-sheep breed-types perform comparably on bermudagrass–ryegrass pastures. Furthermore, Dorper and Suffolk wethers produced carcasses of similar weight, composition, and quality. Yet, chops from hair-sheep breeds were more tender than these particular Suffolk lambs. These results suggest that hair-sheep breeds, reared under easy-care, low input, forage-based feeding systems, can produce quality carcasses. Examination of carcass traits from heavier forage-fed hair breed lambs merits further research.

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